# CLAIMS

What is claimed is:

1. A radio frequency (RF) receiver comprising:

a local oscillator (LO) for generating a local oscillation signal;

first and a second mixers coupled to said LO, for converting a received RF signal to an in-phase intermediate frequency (IF) signal and a quadrature IF signal, respectively;

an LO frequency control module, coupled to said LO, for alternately down-converting a channel frequency by changing an oscillation frequency of said LO;

a down converter, coupled to said first and second mixers, for down converting said in-phase IF signal and said quadrature IF signal to a baseband; and

a down conversion controller, coupled to said down converter, for adjusting a complex sine wave within said down converter.

2. The RF receiver of Claim 1, wherein said LO frequency control module alternately down-converts a channel frequency on a frame-by-frame basis.

3. The RF receiver of Claim 2, wherein said LO frequency control module alternately down-converts a channel frequency by

even frame: $f_{RFLO} = f_{CH} - f_{IF}$

odd frame: $f_{RFLO} = f_{CH} + f_{IF}$

*wherein* $f_{RFLO}$ = said local oscillation frequency

$f_{CH}$ = said channel frequency

$f_{IF}$ = said IF signal frequency

4. The RF receiver of Claim 3, wherein said down conversion controller adjusts a complex sine wave $e^{\pm j\omega t}$ within said down converter by

$$\begin{aligned} \textit{even frame}: \quad IFLO(t) &= e^{-j\omega_{IF}t} \\ \textit{odd frame}: \quad IFLO(t) &= e^{+j\omega_{IF}t} \end{aligned}$$

$$\begin{aligned} \textit{where} \quad e^{-j\omega_{IF}t} &= Cos\omega_{IF}t - jSin\omega_{IF}t \\ e^{+j\omega_{IF}t} &= Cos\omega_{IF}t + jSin\omega_{IF}t \\ \omega_{IF} &= 2\pi f_{IF} \end{aligned}$$

5. The RF receiver of Claim 4, wherein said frames are time-division multiple access (TDMA) frames.

6. The RF receiver of Claim 3, wherein said down conversion controller adjusts a complex sine wave $e^{\pm j\omega t}$ within said down converter by

$$\begin{aligned} \textit{even frame}: \quad IFLO(t) &= e^{+j\omega_{IF}t} \\ \textit{odd frame}: \quad IFLO(t) &= e^{-j\omega_{IF}t} \end{aligned}$$

$$\begin{aligned} \textit{where } e^{-j\omega_{IF}t} &= Cos\omega_{IF}t - jSin\omega_{IF}t \\ e^{+j\omega_{IF}t} &= Cos\omega_{IF}t + jSin\omega_{IF}t \\ \omega_{IF} &= 2\pi f_{IF} \end{aligned}$$

7. The RF receiver of Claim 6, wherein said frames are time-division multiple access (TDMA) frames.

9. The RF receiver of Claim 2, wherein said LO frequency control module alternately down-converts a channel frequency by

even frame: $f_{RFLO} = f_{CH} + f_{IF}$

odd frame: $f_{RFLO} = f_{CH} - f_{IF}$

*wherein* $f_{RFLO}$ = said local oscillation frequency

$f_{CH}$ = said channel frequency

$f_{IF}$ = said IF signal frequency

9. The RF receiver of Claim 8, wherein said down conversion controller adjusts a complex sine wave $e^{\pm j\omega t}$ within said down converter by

$$\begin{aligned} \textit{even frame}: \quad IFLO(t) &= e^{+j\omega_{IF}t} \\ \textit{odd frame}: \quad IFLO(t) &= e^{-j\omega_{IF}t} \end{aligned}$$

$$\begin{aligned} \text{where } e^{-j\omega_{IF}t} &= Cos\omega_{IF}t - jSin\omega_{IF}t \\ e^{+j\omega_{IF}t} &= Cos\omega_{IF}t + jSin\omega_{IF}t \\ \omega_{IF} &= 2\pi f_{IF} \end{aligned}$$

10. The RF receiver of Claim 9, wherein said frames are time-division multiple access (TDMA) frames.

11. The RF receiver of Claim 8, wherein said down conversion controller adjusts a complex sine wave $e^{\pm j\omega t}$ within said down converter by

$$\begin{aligned} \textit{even frame}: \quad IFLO(t) &= e^{-j\omega_{IF}t} \\ \textit{odd frame}: \quad IFLO(t) &= e^{+j\omega_{IF}t} \end{aligned}$$

$$\begin{aligned} \text{where } e^{-j\omega_{IF}t} &= Cos\omega_{IF}t - jSin\omega_{IF}t \\ e^{+j\omega_{IF}t} &= Cos\omega_{IF}t + jSin\omega_{IF}t \\ \omega_{IF} &= 2\pi f_{IF} \end{aligned}$$

12. The RF receiver of Claim 11, wherein said frames are time-division multiple access (TDMA) frames.

13. The RF receiver of Claim 1, wherein said RF receiver further includes an IF filter.

14. The RF receiver of Claim 1, wherein said RF receiver further includes an analog-to-digital converter.

15. A method for enhancing signal quality within a radio frequency (RF) receiver, said method comprising:

receiving a RF signal;

alternately down-converting a channel frequency by changing a local oscillation frequency, wherein said local oscillation frequency is utilized for converting said received RF signal to an in-phase intermediate frequency (IF) signal and a quadrature IF signal; and

adjusting a complex sine wave when down converting said in-phase IF signal and said quadrature IF signal to a baseband signal.

16. The method of Claim 15, wherein said alternately down-converting further includes alternately down-converting said in-phase IF signal and said quadrature IF signal on a frame-by-frame basis.

17. The method of Claim 16, wherein said alternately down-converting is performed by

even frame: $f_{RFLO} = f_{CH} - f_{IF}$

odd frame: $f_{RFLO} = f_{CH} + f_{IF}$

*wherein* $f_{RFLO}$ = said local oscillation frequency

$f_{CH}$ = said channel frequency

$f_{IF}$ = said IF signal frequency

18. The method of Claim 17, wherein said adjusting further includes adjusting a complex sine wave $e^{\pm j\omega t}$ by

$$\begin{aligned} \textit{even frame}:\ & IFLO(t) = e^{-j\omega_{IF}t} \\ \textit{odd frame}:\ & IFLO(t) = e^{+j\omega_{IF}t} \end{aligned}$$

$$\begin{aligned} \textit{where}\ e^{-j\omega_{IF}t} &= Cos\omega_{IF}t - jSin\omega_{IF}t \\ e^{+j\omega_{IF}t} &= Cos\omega_{IF}t + jSin\omega_{IF}t \\ \omega_{IF} &= 2\pi f_{IF} \end{aligned}$$

19. The method of Claim 18, wherein said frames are time-division multiple access (TDMA) frames.

20. The method of Claim 17, wherein said adjusting further includes adjusting a complex sine wave $e^{\pm j\omega t}$ by

$$
\begin{aligned}
\textit{even frame:}\quad IFLO(t) &= e^{+j\omega_{IF}t} \\
\textit{odd frame:}\quad IFLO(t) &= e^{-j\omega_{IF}t}
\end{aligned}
$$

$$
\begin{aligned}
\textit{where}\ e^{-j\omega_{IF}t} &= Cos\omega_{IF}t - jSin\omega_{IF}t \\
e^{+j\omega_{IF}t} &= Cos\omega_{IF}t + jSin\omega_{IF}t \\
\omega_{IF} &= 2\pi f_{IF}
\end{aligned}
$$

21. The method of Claim 20, wherein said frames are time-division multiple access (TDMA) frames.

22. The method of Claim 17, wherein said alternately down-converting is performed by

even frame: $f_{RFLO} = f_{CH} + f_{IF}$

odd frame: $f_{RFLO} = f_{CH} - f_{IF}$

*wherein* $f_{RFLO}$ = said local oscillation frequency

$f_{CH}$ = said channel frequency

$f_{IF}$ = said IF signal frequency

23. The method of Claim 22, wherein said adjusting further includes adjusting a complex sine wave $e^{\pm j\omega t}$ by

$$\begin{aligned} \textit{even frame:}\quad IFLO(t) &= e^{+j\omega_{IF}t} \\ \textit{odd frame:}\quad IFLO(t) &= e^{-j\omega_{IF}t} \end{aligned}$$

$$\begin{aligned} \textit{where}\ e^{-j\omega_{IF}t} &= Cos\omega_{IF}t - jSin\omega_{IF}t \\ e^{+j\omega_{IF}t} &= Cos\omega_{IF}t + jSin\omega_{IF}t \\ \omega_{IF} &= 2\pi f_{IF} \end{aligned}$$

24. The method of Claim 23, wherein said frames are time-division multiple access (TDMA) frames.

25. The method of Claim 22, wherein said adjusting further includes adjusting a complex sine wave $e^{\pm j\omega t}$ by

$$\begin{aligned} \textit{even frame:}\quad IFLO(t) &= e^{-j\omega_{IF}t} \\ \textit{odd frame:}\quad IFLO(t) &= e^{+j\omega_{IF}t} \end{aligned}$$

$$\begin{aligned} \textit{where}\ e^{-j\omega_{IF}t} &= Cos\omega_{IF}t - jSin\omega_{IF}t \\ e^{+j\omega_{IF}t} &= Cos\omega_{IF}t + jSin\omega_{IF}t \\ \omega_{IF} &= 2\pi f_{IF} \end{aligned}$$

26. The method of Claim 25, wherein said frames are time-division multiple access (TDMA) frames.

27. A radio frequency (RF) receiver comprising:

a local oscillator (LO) for generating a local oscillation signal;

first and second mixers coupled to said LO, for converting a received RF signal to an in-phase intermediate frequency (IF) signal and a quadrature IF signal, respectively;

an LO frequency control module, coupled to said LO, for alternately down-converting a channel frequency by changing an oscillation frequency of said LO;

a switch, coupled to said first and second mixers, for alternately swapping signals paths of said in-phase IF signal and said quadrature IF signal in synchronization with an oscillation frequency of said LO; and

a down converter, coupled to said switch, for down converting said in-phase IF signal and said quadrature IF signal to a baseband signal.

28. The RF receiver of Claim 27, wherein said LO frequency control module alternately down-converts a channel frequency on a frame-by-frame basis.

29. The RF receiver of Claim 28, wherein said LO frequency control module alternately down-converts a channel frequency by

even frame: $f_{RFLO} = f_{CH} - f_{IF}$

odd frame: $f_{RFLO} = f_{CH} + f_{IF}$

*wherein* $f_{RFLO}$ = said local oscillation frequency

$f_{CH}$ = said channel frequency

$f_{IF}$ = said IF signal frequency

30. The RF receiver of Claim 29, wherein said frames are time-division multiple access (TDMA) frames.

31. The RF receiver of Claim 28, wherein said LO frequency control module alternately down-converts a channel frequency by

even frame: $f_{RFLO} = f_{CH} + f_{IF}$

odd frame: $f_{RFLO} = f_{CH} - f_{IF}$

*wherein* $f_{RFLO}$ = said local oscillation frequency

$f_{CH}$ = said channel frequency

$f_{IF}$ = said IF signal frequency

32. The RF receiver of Claim 31, wherein said frames are time-division multiple access (TDMA) frames.

33. The RF receiver of Claim 27, wherein said RF receiver further includes an IF filter.

34. The RF receiver of Claim 27, wherein said RF receiver further includes an analog-to-digital converter.

35. A method for enhancing signal quality within a radio frequency (RF) receiver, said method comprising:

receiving a RF signal;

alternately down-converting a channel frequency by changing a local oscillation frequency, wherein said local oscillation frequency is utilized for converting said received RF signal to an in-phase intermediate frequency (IF) signal and a quadrature IF signal;

alternately swapping signals paths of said in-phase IF signal and said quadrature IF signal in synchronization with said local oscillation frequency; and

down converting said in-phase IF signal and said quadrature IF signal to a baseband.

36. The method of Claim 35, wherein said alternately down-converting further includes alternately down-converting said in-phase IF signal and said quadrature IF signal on a frame-by-frame basis.

37. The method of Claim 36, wherein said alternately down-converting is performed by

even frame: $f_{RFLO} = f_{CH} - f_{IF}$

odd frame: $f_{RFLO} = f_{CH} + f_{IF}$

*wherein* $f_{RFLO}$ = said local oscillation frequency

$f_{CH}$ = said channel frequency

$f_{IF}$ = said IF signal frequency

38. The method of Claim 38, wherein said frames are time-division multiple access (TDMA) frames.

39. The method of Claim 37, wherein said alternately down-converting is performed by

even frame: $f_{RFLO} = f_{CH} + f_{IF}$

odd frame: $f_{RFLO} = f_{CH} - f_{IF}$

*wherein* $f_{RFLO}$ = said local oscillation frequency

$f_{CH}$ = said channel frequency

$f_{IF}$ = said IF signal frequency

40. The method of Claim 39, wherein said frames are time-division multiple access (TDMA) frames.